※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Systemic lupus erythematosis (SLE) is an autoimmune disease for which there are two basic methods of diagnosis – one method involves the detection of anti-nuclear antibody (ANA) and the other involves detection of anti-DNA antibody. The ANA test has a sensitivity of 80% and a specificity of 70%. The anti-DNA test has a sensitivity of 90% and a specificity of 90%. Suppose a young patient has some protein in her urine and other general symptoms that indicate the possibility of SLE. Prior to any diagnostic testing, the probability of disease is considered to be approximately 20%.

    (a) The patient undergoes an ANA test, which is positive. What is your revised estimate of her probability of having SLE? Show any calculations. (5%)

    (b) Further testing with anti-DNA results in a negative test. Taking both test results into account, what is your estimate of the probability of SLE in this patient? Show any calculations. (5%)

2. A study was designed to assess whether cigarette smoking increases the incidence of type 2 diabetes mellitus (DM). Nearly 100,000 nondiabetic subjects aged 50-75 were enrolled in the study in 2000 and followed through 2005 for development of type 2 diabetes. Diabetes status was determined by plasma glucose, measured during annual follow-up examinations.

    Data from the study are summarized below, stratified on parental history of diabetes:

	+ Parental history			no Parental history	
	Smoking	No Smoking		Smoking	No Smoking
DM	60	400	DM	120	3,000
Person-Yrs	2000	20,000	Person-Yrs	20,000	300,000

    (a).Is there evidence of effect modification (by parental history of diabetes) on a multiplicative scale? (Show any calculations and justify your answer.) (5%)

    (b).What is the expected value of the rate difference (incidence density difference) for a subject exposed to both risk factors (smoking and positive family history), assuming the factors act independently? (5%)

    (c).Considering only those subjects with a positive parental history of diabetes, what is the expected number of exposed cases, under the null hypothesis of no association between smoking and DM? (5%)

(d).In the discussion section, the authors state that "a strength of the present study is the use of a large cohort in which the incidence of diabetes was ascertained by blood glucose level, as opposed to many previous studies, which ascertained the incidence by questionnaire". Which one of the following issues is being addressed in this excerpt? (5%)

(A) Effect modification　　　　(B) Consistency

(C)Disease misclassification　　(D)External validity

3. A case-control study was conducted to evaluate the relationship between a woman's self-reported use of vitamin supplements and subsequent delivery of a child with birth defects. When the study was published, its authors were criticized for having chosen a control group with an inappropriately high prevalence of multivitamin use. What impact would the use of such a control group have on the observed odds ratio? (Assume that the exposure is truly protective.) (5%)

(A) It would create bias, but the direction cannot be predicted

(B) It would create bias away from the null

(C) It would create bias toward the null

(D) It would increase the probability of a type II error

4. Among patients with oral cancer, smokers have a worse prognosis than nonsmokers. When compared with a case-control study based upon incident cases only, a case-control study utilizing prevalent cases of oral cancer would likely have which of the following effect on the observed association between smoking and elevated risk of developing oral cancer? (5%)

(A) Increase

(B) Decrease

(C) Remain unchanged

(D)Change, but direction cannot be predicted

5.Indicate whether each of the following statements is true or false by placing a T or an F. (10%; 2% each)

(a) A direct age-adjusted (or age-standardized) mortality rate is a weighted average of age-specific mortality rates.

(b) Indirect adjustment of rates is often used when the size of the standard population is too small to allow for calculation of meaningful rates.

(c) An odds is a ratio of two proportions.

(d) The incidence density difference (IDD) is an indicator of the rate of disease that is attributable to a given exposure.

(e) A standardized mortality ratio (SMR) is a ratio of two mortality rates.

6. Define the terms "Type I Error" and "Type II Error". (10%)

7. 請比較母數統計分析方法(parametric tests)和無母數分析方法(nonparametric tests)之主要差異與優缺點(10%)。

8. 假設健康成人的心率為常態分布。抽樣 200 名健康成人所估計之平均心率 95%信賴區間為每分鐘 66.12 至 77.88 下，請算出健康成人平均心率之 90%之信賴區間。(10%)

$$(Z_{0.90} = 1.28, \ Z_{0.95} = 1.64, \ Z_{0.975} = 1.96)$$

9. 小明擲骰子 60 次之結果如下，試檢定此骰子是否為公平（設 α=0.05, $\chi^2_{0.95;5}$ =11.07）。(10%)

骰子點數	1	2	3	4	5	6
出現次數	8	7	15	9	9	12

10. 某研究探討某工廠工人血中鉛濃度與血紅素值的關係，結果如下表

血中鉛值	n	平均值	標準差
<10	20	14.5	1.0
10－40	10	14.0	2.0
>40	10	13.0	2.0

試檢定工人之血紅素值是否因血中鉛值不同而有差異（設 α=0.05）(10%)。

$$(F_{0.95;2,37}=3.25; \ F_{0;95,2,38}=3.24; \ F_{0.95;2,39}=3.24; \ F_{0.95;3,37}=2.87; \ F_{0.95;3,38}=2.86;$$

$$F_{0.95;3,39}=2.85)。$$